

DOV/68-59-3-2/23

# Classification of Coking Coals

where  $w$  - moisture;  $A$  - ash;  $C$ ,  $H$ ,  $N$  and  $CO_2$  - carbon, hydrogen, nitrogen and  $CO_2$  content of coal respectively. If the amount of oxygen determined directly and by difference differed by more than 0.5% the analysis was repeated after treating the coal by a dilute hydrochloric acid. The analysis of the results obtained indicated that the most accurate classification of coals from various coal basins according to their technological value and ability to produce coke with a given set of physical properties can be obtained in two coordinate systems constructed on the following relationships:

$$\text{ordinate} = \frac{H \times 100}{C + 0.5S_{org} + 0.5S_{pyr}}$$

$$\text{abscissa} = \frac{O}{H + 0.5 S_{org}}$$

Card 2/8 In these relationships the values for the content of elements can be taken as determined or recalculated on

DOV/65-59-3-2/23

# Classification of Coking Coals

the organic part of coal according to the formula:

$$X^0 = X^a \frac{100}{100 - (W^a + A^a + 0.625 S^a_{pyr} + CO_2^a)}$$

where  $X^a$  - analytical values of elements C, H, N, S and O

$X^0$  - their recalculation on the organic part of a coal.

The classification diagram is shown in fig.1. All caking and weakly caking coals were divided into classes, groups and types. As a basis for the division into classes the strength of coke produced as determined in a standard drum was taken. All coals were divided into 7 classes:

| Class of coal | Strength of coke<br>(kg residue in a<br>standard drum) |
|---------------|--------------------------------------------------------|
|---------------|--------------------------------------------------------|

|   |           |
|---|-----------|
| 1 | > 315     |
| 2 | 300 - 315 |
| 3 | 270 - 300 |

Card 3/8

NOV/68-59-3-2/23

Classification of Coking Coals

|   |                           |
|---|---------------------------|
| 4 | 220 - 270                 |
| 5 | 100 - 200                 |
| 6 | < 100                     |
| 7 | lump coke is not obtained |

The division of coals into groups was based on the properties of a coal to produce coke more resistant to abrasion than to crushing (i.e. coals which can be blended with a certain amount of weakly or non-caking coals with an increase or without a loss of strength) or vice versa. The first group of coals was called fattening coals "OZh" and the second - leaning coals "OT". The above nomenclature is not related to the volatile matter content of coals. There are also coals which on blending with either OZh or OT coals produce coke of a lower quality than when coked alone - this group was called intermediate coals "PR". Coals of the 7th class i.e. weakly coking coals were placed in the fourth group with an index "SS". The division of coals into types was based on the following: any fattening coal (OZh) on addition of a

Card 4/8

SOV/68-59-3-2/23

Classification of Coking Coals

leaning coal (OT) to it, produces coke of increased strength, the degree of the increase in strength depends on the position of the two coals on the diagram. The nearer the position of the two coals to the ordinate and the further from the line separating caking coals from non-caking coals, the higher will be the effect of blending. Therefore, the division into types was based on the value of the ratio

$$\frac{0}{H + 0.5 S \text{ org}}$$

All caking coals were divided into 37 types as follows: OZh - 16 types, OT - 8 types, PR - 6 types and SS - 7 types. Each coal can be identified by a code e.g. 4OZh1 which means that the coal belongs to the 4th class producing coke of a strength somewhat below 270 kg, it is capable of producing stronger coke on blending with a leaning coal. The last number of the code indicates that the coal can be blended with a wide range of leaning coals with an improvement in the quality of coke. From the diagram it is also possible to determine the strength

Card 5/8

SOV/68-59-3-2/23

### Classification of Coking Coals

of coke produced from a mixture of OZh and OF coals by an arithmetical calculation of the arithmetic mean parameters of the blend on the basis of parameters of the individual coals. However, the additivity of properties of binary and multicomponent blends is valid only for the left part of the diagram, approximately to the value of the abscissa of about 0.8. The proposed classification system shows also the changes in the composition of coals under the influence of the individual genetic factors, such as petrographic composition and the degree of metamorphic transformation. On the basis of petrographic composition coals were divided into the following groups according to the percentage content of petrographic components capable of softening on thermal treatment <30%, 30-40%, 40-50%, 50-60%, 60-70%, 70-80% and >80%. The following petrographic components were assumed to be capable of softening: all microcomponents of the vitrinite and leptinite group, 1/3 of microcomponents of semivitrinite group with the exception of structural semitelenite which was taken as an unsoftening component

Card 6/8

SOV/68-59-3-2/23

### Classification of Coking Coals

for all stages of metamorphism. The degree of metamorphism is determined by reflectivity (ref 3) and not by the volatile content. All coals were divided into 12 groups of these 10 groups comprise caking coals. Each metamorphic group is signified by a Roman figure and given a name: I - long flame; II - gas 1; III - gas 2; IV - gas-fat; V - fat 1; VI - fat 2; VII - coking fat; VIII - coking 1; IX-coking 2; X - lean caking; XI - lean weakly caking and XII - lean non caking. The isolines of equal content of fuseable petrographic components and lines dividing into metamorphic groups as well as the direction of the change in the position of coals on oxidation are shown in fig.2 and isolines of equal content of volatile matter and iso-lines of equal thickness of plastic layer in fig.3. The distribution of all mineral fuels on the diagram of the proposed classification is shown in fig.4. It is claimed that the proposed classification not only indicates similarities and differences in the individual coals but also explains the cause of these differences. In the

Card 7/8

SOV/68-59-3-2/23

Classification of Coking Coals

editorial notice the importance of single classification of coals is stressed and an invitation is issued for a discussion on the subject. There are 4 figures and 4 Soviet references.

ASSOCIATION: VUKHLIN

Card 8/8

PANCHENKO, S.I.

Permissible ash content of blast furnace coke and the optimum  
concentration of coking coals. Koks i khim. no.4:3-6 '60.  
(MIRA 13:6)

1. Vostochnyy uglekhimicheskiy institut.  
(Coke--Analysis) (Coal preparation)



OSTROUKHOV, M.Ya.; PANCHENKO, S.I.; Prinimali uchastiye: FRISHBERG, V.D.;  
PETROV, V.K.; RESHETKO, A.; VIATKIN, G.P.; BRATCHENKO, V.P.;  
POFANOV, A.A.; MILYAYEV, M.N.; PRIVALOV, V.Ye.; MUSTAFIN, P.A.;  
PUSHKASH, I.I.; LAZAREV, B.L.

Experimental blast furnace smelting using coke from wet  
preparation coals. [Sbor. trud.] Nauch.-issl.inst.met.  
no.4:63-70 '61. (MIRA 15:11)

1. Vostochnyy uglekhimicheskiy institut (for Ostroukhov, Panchenko,  
Frishberg, Petrov, Reshetko). 2. Nauchno-issledovatel'skiy institut  
metallurgii (for Vyatkin, Bratchenko). 3. Nishne-Tagil'skiy  
metallurgicheskiy kombinat (for Privalov, Mustafin, Pushkash,  
Lazarev).

(Blast furnaces—Testing)  
(Coke—Testing)

TSIPEROVICH, Moisey Veniaminovich, otv. red.; RYAZHICA, E.S.,  
red.; KOLESOV, A.P., red.; PANCHENKO, S.I., red.;  
FEL'DBAIN, M.G., red.; CHAPAYKINA, P.K., red. izd-va;  
KOROL', V.P., tekhn. red.

[Coal preparation and coking] Podgotovka i koksovanie uglei;  
sbornik statei. Sverdlovsk, Metallurgizdat. No.3. 1962.  
415 p. (MIRA 16:12)

1. Sverdlovsk. Vostochnyy nauchno-issledovatel'skiy ugle-  
khimicheskiy institut.

(Coal preparation) (Coke)

GRYAZNOV, Nikolay Sergeyevich; ARONOV, S.G., doktor tekhn. nauk,  
retsensent; PANCHENKO, S.I., doktor tekhn. nauk, red.;  
KRYZHOVA, M.L., red. izd-va; MAL'KOVA, N.T., tekhn. red.

[Plasticity and the caking of coals]Plasticheskoe sosto-  
ianie i spekanie uglei. Sverdlovsk, Metallurgizdat, 1962.  
191 p. (MIRA 15:9)

(Coal—Testing) (Coke)

MIROSHNICHENKO, A.M., kand. tekhn. nauk; PANCHENKO, S.I., doktor tekhn. nauk; SHTRONBERG, B.I., kand. tekhn. nauk; FRISHBERG, V.D., kand. tekhn. nauk; BAYDALINOV, P.A., inzh.; GILAZOV, M.S., doktor tekhn. nauk; ZASHKVARA, V.G., doktor tekhn. nauk; LAZOVSKIY, I.M., kand. tekhn. nauk; MARINICHEV, B.T., inzh.; FEL'DBRIN, M.G., kand. tekhn. nauk; BAKUN, N.A., inzh.; BARATS, B.M., inzh.; VOZNYI, G.F., kand. tekhn. nauk; MIKHAL'CHUK, A.M., inzh.; TOPORKOV, V.Ya., kand. tekhn. nauk; FLORINSKIY, N.V., inzh.; KHAYET, A.N., inzh.; SHELKOV, A.K., inzh., red.; ARON V, S.G., doktor tekhn. nauk, red.; PLECHBRAZHENSKIY, P.I., inzh., red.

[Manual for coke chemists in six volumes] Spravochnik koksokhimi-  
mika v shesti tomakh. Moskva, Izd-vo "Metallurgiya." Vol.1.  
[Source of raw materials and preparation of coal for coking]  
Syr'evaya baza i podgotovka uglei k koksovaniyu. 1964. 490 p.  
(EIRA 17:5)

End

~~11/10~~

405

END

END